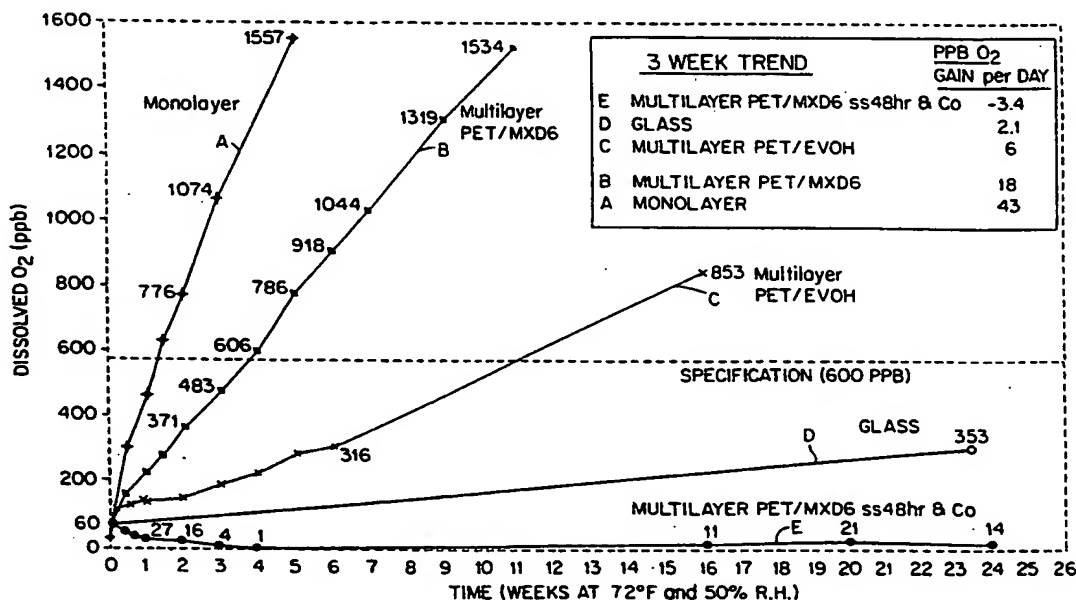




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

| | | | |
|--|--|--|---|
| (51) International Patent Classification ⁶ : C08K 5/098, B32B 27/18, 27/34, 33/00, B65D 65/38, 81/26, C08K 5/00, C08G 69/48, 69/46, C08K 3/08 | | A3 | (11) International Publication Number: WO 99/38914 |
| | | | (43) International Publication Date: 5 August 1999 (05.08.99) |
| (21) International Application Number: PCT/US99/02312 | | (81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). | |
| (22) International Filing Date: 2 February 1999 (02.02.99) | | Published With international search report. | |
| (30) Priority Data: 09/018,217 3 February 1998 (03.02.98) US 09/169,439 9 October 1998 (09.10.98) US 09/236,498 26 January 1999 (26.01.99) US | | (88) Date of publication of the international search report: 15 June 2000 (15.06.00) | |
| (71) Applicant (for all designated States except US): CONTINENTAL PET TECHNOLOGIES, INC. [US/US]; Suite 490, 7310 Turfway Road, Florence, KY 41042 (US). | | | |
| (72) Inventors; and (75) Inventors/Applicants (for US only): SCHMIDT, Steven, L. [US/US]; 39 McIntosh Lane, Bedford, NH 03110 (US). LYNCH, Brian [US/US]; 22 Woodward Drive, Merrimack, NH 03054 (US). BARKER, Keith [US/US]; 14 Main Street, Candia, NH 03034 (US). ADAMS, Ronald [US/US]; 33A Appletree Drive, Goffstown, NH 03045 (US). AGRAWAL, Amit, S. [IN/US]; 141 London Court, Merrimack, NH 03054 (US). | | | |
| (74) Agent: HENDRICKS, Therese, A.; Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210 (US). | | | |

(54) Title: ENHANCED OXYGEN-SCAVENGING POLYMERS, AND PACKAGING MADE THEREFROM



(57) Abstract

Oxygen-scavenging polymers and packaging for holding oxygen-sensitive products. A heat treatment process has been found to significantly increase the oxygen-scavenging performance of the polymer. The enhanced scavenging polymer can be effectively incorporated into various packaging, including transparent multilayer containers for beer and juice. In one embodiment, a multilayer package made from the scavenger provides an actual reduction in oxygen content of a contents of the package, over a long period of time (e.g., 24 weeks). The package can be stored unfilled for an extended period (without significant loss of scavenging capability) and will scavenge substantially immediately upon filling with a liquid product. The package may incorporate a relatively low weight percentage of the scavenger, thus providing enhanced scavenging in a cost-effective manner.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 99/02312

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C08K5/098 B32B27/18 B32B27/34 B32B33/00 B65D65/38
B65D81/26 C08K5/00 C08G69/48 C08G69/46 C08K3/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C08K B32B B65D C08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|--|
| X | EP 0 520 257 A (GRACE W R & CO) 30 December 1992 (1992-12-30) | 1-12, 15, 24, 25, 27, 30-37, 39, 40, 58-60, 62-64, 68, 70, 76, 78, 79 5 |
| X | page 2, line 24-32 -page 3, line 46, 47; claims 1-3, 14-17, 22, 25, 26, 28-36 | |
| X | page 4, line 19-34-36 -page 5, line 32-46-54; examples 10, CONTROL, 1-2 | 3, 30-32, 37 |
| X | page 6, line 20-26-42 -page 7, line 18-33-44 | 9-11 |
| A | page 7, line 44-53-56 | 16-22, 26, 28, 29 23-25, 27, 67, |
| Y | -/- | |

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search

9 March 2000

Date of mailing of the international search report

23. 03. 2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Derz, T

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/02312

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|--|
| X | EP 0 507 207 A (GRACE W R & CO) 7 October 1992 (1992-10-07) | 71,80-82 1-12, 15, 24, 25, 27, 30-37, 39, 40, 58-60, 62-64, 68, 70, 76, 78, 79 23-25, 27, 67, 71,80-82 |
| Y | page 2, line 55-58 -page 5, line 38; claims | |
| X | EP 0 301 719 A (MB GROUP PLC) 1 February 1989 (1989-02-01) | 1-12, 14, 19, 23, 24, 33, 36 22 |
| A | claims 1, 11, 13, 16, 35-38 | |
| X | EP 0 380 319 A (CMB FOODCAN PLC) 1 August 1990 (1990-08-01) page 2, line 32-55; claims 1, 7 | 1, 2, 6, 7 |
| X | WO 90 00504 A (PLM AB ;HAUSTRUP PLASTIC AS (DK); HAUSTRUP HOLDING AS (DK)) 25 January 1990 (1990-01-25) | 1-6, 10-12, 14, 24, 36, 38, 39, 42, 58-61, 64, 67, 69-71, 77, 79 37, 51 |
| A | page 10, paragraphs 1, 2; claims 1, 3-5, 10; example 2 | |
| X | WO 90 00578 A (PLM AB ;HAUSTRUP PLASTIC AS (DK); HAUSTRUP HOLDING AS (DK)) 25 January 1990 (1990-01-25) the whole document | 1-5 |
| X | WO 96 18685 A (CONTINENTAL PET TECHNOLOGIES) 20 June 1996 (1996-06-20) | 1-12, 14, 15, 19, 22-24, 33-36, 71, 76 51, 52 |
| A | page 5, line 19-21 -page 9, line 3-5; claims 1-3, 6, 8, 9, 11, 17, 18, 20, 23, 26, 27, 30, 31, 34, 36 -38; figures 4-9, 11 | |
| X | WO 96 18686 A (CONTINENTAL PET TECHNOLOGIES) 20 June 1996 (1996-06-20) the whole document | 1, 2, 6-12 |

-/-

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 99/02312

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| E | US 5 866 649 A (CORNELL STEPHEN W ET AL) 2 February 1999 (1999-02-02) claims 1-7, 10-12, 27-35 | 55, 56, 72 |
| X | US 5 639 815 A (COCHRAN MICHAEL ALEXANDER ET AL) 17 June 1997 (1997-06-17) claims 1-5, 20, 21; examples 1-5 | 55, 56, 72 |

INTERNATIONAL SEARCH REPORT

Int ernational application No.
PCT/US 99/02312

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-54,58-71,73-82

The claims of the first subject define (1) oxygen scavenging polymeric compositions for aqueous liquid (beer) packaging to achieve oxygen removal from the liquid. This concept includes also (2) a method of heating a PA + 200ppm Co O₂-scavenger composition at low level O₂ atmosphere and (3) removing oxygen content of a packed liquid at low ppm level and maintaing it there for months.

2. Claims: 55-57, 72

Method of reducing the melt index of polyamide by adding a metal to it.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/02312

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| EP 0520257 A | 30-12-1992 | US 5211875 A | 18-05-1993 |
| | | AT 183533 T | 15-09-1999 |
| | | AU 650140 B | 09-06-1994 |
| | | AU 1811192 A | 07-01-1993 |
| | | AU 659773 B | 25-05-1995 |
| | | AU 5930594 A | 16-06-1994 |
| | | CA 2071079 A | 28-12-1992 |
| | | DE 69229817 D | 23-09-1999 |
| | | FI 922969 A | 28-12-1992 |
| | | HU 66841 A, B | 30-01-1995 |
| | | IL 102160 A | 27-11-1995 |
| | | JP 5194949 A | 03-08-1993 |
| | | MX 9203389 A | 01-12-1992 |
| | | NO 922537 A | 28-12-1992 |
| | | NZ 243077 A | 27-09-1993 |
| | | PL 175843 B | 26-02-1999 |
| | | PL 172392 B | 30-09-1997 |
| | | SK 197192 A | 07-09-1994 |
| | | RU 2093441 C | 20-10-1997 |
| | | US 5425896 A | 20-06-1995 |
| | | US 5498364 A | 12-03-1996 |
| | | ZA 9204349 A | 24-02-1993 |
| EP 0507207 A | 07-10-1992 | AU 657728 B | 23-03-1995 |
| | | AU 1141092 A | 08-10-1992 |
| | | CA 2062083 A | 03-10-1992 |
| | | CS 9201000 A | 14-10-1992 |
| | | FI 921425 A | 03-10-1992 |
| | | HU 67219 A | 28-03-1995 |
| | | IL 101161 A | 14-05-1996 |
| | | JP 5115776 A | 14-05-1993 |
| | | MX 9201379 A | 01-10-1992 |
| | | NO 921268 A | 05-10-1992 |
| | | NZ 241802 A | 22-12-1994 |
| | | PL 171849 B | 30-06-1997 |
| | | PL 172483 B | 30-09-1997 |
| | | RU 2092513 C | 10-10-1997 |
| | | US 5346644 A | 13-09-1994 |
| | | US 5529833 A | 25-06-1996 |
| | | US 5700554 A | 23-12-1997 |
| EP 0301719 A | 01-02-1989 | US 5350622 A | 27-09-1994 |
| | | ZA 9201914 A | 16-09-1993 |
| | | AU 611181 B | 06-06-1991 |
| | | AU 1987888 A | 01-03-1989 |
| | | CA 1335912 A | 13-06-1995 |
| | | DK 143689 A | 26-05-1989 |
| | | FI 891396 A | 23-03-1989 |
| | | WO 8901012 A | 09-02-1989 |
| | | GB 2207439 A, B | 01-02-1989 |
| | | HK 34895 A | 24-03-1995 |
| | | IE 60650 B | 10-08-1994 |
| | | JP 2500846 T | 22-03-1990 |
| | | JP 2991437 B | 20-12-1999 |
| | | KR 126141 B | 26-12-1997 |
| | | MX 171000 B | 24-09-1993 |
| | | NO 300423 B | 26-05-1997 |
| | | NZ 225347 A | 27-08-1991 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/02312

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| EP 0301719 A | | SG 12195 G | 16-06-1995 |
| | | TR 23400 A | 29-12-1989 |
| | | US 5021515 A | 04-06-1991 |
| | | US 5639815 A | 17-06-1997 |
| | | US 5955527 A | 21-09-1999 |
| | | ZA 8804895 A | 26-04-1989 |
| | | AU 618341 B | 19-12-1991 |
| | | AU 3344889 A | 05-10-1989 |
| | | CA 1324329 A | 16-11-1993 |
| | | DK 565389 A | 10-11-1989 |
| | | EP 0335520 A | 04-10-1989 |
| | | WO 8908557 A | 21-09-1989 |
| | | GB 2216462 A, B | 11-10-1989 |
| | | JP 2785405 B | 13-08-1998 |
| | | JP 3503153 T | 18-07-1991 |
| | | KR 9608290 B | 24-06-1996 |
| | | NO 176023 B | 10-10-1994 |
| | | US 5049624 A | 17-09-1991 |
| | | ZA 8901864 A | 28-02-1990 |
| EP 0380319 A | 01-08-1990 | CA 2008479 A | 27-07-1990 |
| | | GB 2230530 A | 24-10-1990 |
| | | JP 3000762 A | 07-01-1991 |
| | | ZA 9000517 A | 28-11-1990 |
| | | US 5239016 A | 24-08-1993 |
| WO 9000504 A | 25-01-1990 | SE 464086 B | 04-03-1991 |
| | | AT 102889 T | 15-04-1994 |
| | | AU 616293 B | 24-10-1991 |
| | | AU 3981889 A | 05-02-1990 |
| | | CA 1338996 A | 11-03-1997 |
| | | DE 68913977 D | 21-04-1994 |
| | | DE 68913977 T | 15-09-1994 |
| | | DK 4191 A | 10-01-1991 |
| | | EP 0427751 A | 22-05-1991 |
| | | FI 101310 B | 29-05-1998 |
| | | JP 3505888 T | 19-12-1991 |
| | | NO 177150 B | 18-04-1995 |
| | | SE 8802610 A | 12-01-1990 |
| | | US 5159005 A | 27-10-1992 |
| WO 9000578 A | 25-01-1990 | SE 464085 B | 04-03-1991 |
| | | AT 103954 T | 15-04-1994 |
| | | AU 616043 B | 17-10-1991 |
| | | AU 3976889 A | 05-02-1990 |
| | | CA 1338995 A | 11-03-1997 |
| | | DE 68914460 D | 11-05-1994 |
| | | DE 68914460 T | 15-09-1994 |
| | | DK 4091 A | 10-01-1991 |
| | | EP 0429476 A | 05-06-1991 |
| | | FI 101309 B | 29-05-1998 |
| | | JP 2948606 B | 13-09-1999 |
| | | JP 3505843 T | 19-12-1991 |
| | | NO 177600 B | 10-07-1995 |
| | | SE 8802609 A | 12-01-1990 |
| | | US 5194478 A | 16-03-1993 |
| WO 9618685 A | 20-06-1996 | US 5759653 A | 02-06-1998 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/02312

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|-------------------------|------------------|
| WO 9618685 A | | AU 711170 B | 07-10-1999 |
| | | AU 4377996 A | 03-07-1996 |
| | | AU 709271 B | 26-08-1999 |
| | | AU 4466996 A | 03-07-1996 |
| | | BR 9510039 A | 03-11-1998 |
| | | BR 9510457 A | 15-12-1998 |
| | | CA 2207680 A | 20-06-1996 |
| | | CA 2207825 A | 20-06-1996 |
| | | EP 0797627 A | 01-10-1997 |
| | | EP 0797628 A | 01-10-1997 |
| | | JP 11514385 T | 07-12-1999 |
| | | WO 9618686 A | 20-06-1996 |
| | | US 5952066 A | 14-09-1999 |
| WO 9618686 A | 20-06-1996 | US 5759653 A | 02-06-1998 |
| | | AU 711170 B | 07-10-1999 |
| | | AU 4377996 A | 03-07-1996 |
| | | AU 709271 B | 26-08-1999 |
| | | AU 4466996 A | 03-07-1996 |
| | | BR 9510039 A | 03-11-1998 |
| | | BR 9510457 A | 15-12-1998 |
| | | CA 2207680 A | 20-06-1996 |
| | | CA 2207825 A | 20-06-1996 |
| | | EP 0797627 A | 01-10-1997 |
| | | EP 0797628 A | 01-10-1997 |
| | | JP 11514385 T | 07-12-1999 |
| | | WO 9618685 A | 20-06-1996 |
| | | US 5952066 A | 14-09-1999 |
| US 5866649 A | 02-02-1999 | US 5281360 A | 25-01-1994 |
| | | US 5314987 A | 24-05-1994 |
| US 5639815 A | 17-06-1997 | US 5955527 A | 21-09-1999 |
| | | AU 611181 B | 06-06-1991 |
| | | AU 1987888 A | 01-03-1989 |
| | | CA 1335912 A | 13-06-1995 |
| | | DK 143689 A | 26-05-1989 |
| | | EP 0301719 A | 01-02-1989 |
| | | FI 891396 A | 23-03-1989 |
| | | WO 8901012 A | 09-02-1989 |
| | | GB 2207439 A, B | 01-02-1989 |
| | | HK 34895 A | 24-03-1995 |
| | | IE 60650 B | 10-08-1994 |
| | | JP 2500846 T | 22-03-1990 |
| | | JP 2991437 B | 20-12-1999 |
| | | KR 126141 B | 26-12-1997 |
| | | MX 171000 B | 24-09-1993 |
| | | NO 300423 B | 26-05-1997 |
| | | NZ 225347 A | 27-08-1991 |
| | | SG 12195 G | 16-06-1995 |
| | | TR 23400 A | 29-12-1989 |
| | | US 5021515 A | 04-06-1991 |
| | | ZA 8804895 A | 26-04-1989 |
| | | AU 618341 B | 19-12-1991 |
| | | AU 3344889 A | 05-10-1989 |
| | | CA 1324329 A | 16-11-1993 |
| | | DK 565389 A | 10-11-1989 |
| | | EP 0335520 A | 04-10-1989 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/02312

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| US 5639815 A | | WO 8908557 A | 21-09-1989 |
| | | GB 2216462 A, B | 11-10-1989 |
| | | JP 2785405 B | 13-08-1998 |
| | | JP 3503153 T | 18-07-1991 |
| | | KR 9608290 B | 24-06-1996 |
| | | NO 176023 B | 10-10-1994 |
| | | US 5049624 A | 17-09-1991 |
| | | ZA 8901864 A | 28-02-1990 |
| | | US 5239016 A | 24-08-1993 |